A PRELIMINARY LIST OF THE FAUNA OF THE ALLEGHENY AND CONEMAUGH SERIES IN WESTERN PENNSYLVANIA.

By Percy E. Raymond.

Allegheny Series, Vanport Limestone.

In the Allegheny series there is, so far as is now known, only one horizon at which marine fossils may be obtained. The Vanport is usually a limestone, although in places it is replaced by a fossiliferous shale. The thickness varies from 1 to 25 feet and the base is usually about 250 feet below the top of the Allegheny series. This limestone is very persistent west of the Chestnut Ridge and north of the latitude of Pittsburgh. Fossils are abundant at nearly all exposures but good specimens can be obtained only where there are shaly layers. Collections have been made at Rochester, Beaver Falls, Wampum, New Castle, Kittanning, and Roaring Run, and the commoner species are listed in the accompanying table.

While there has not yet been enough collecting done to determine accurately the range of the various species in the Pennsylvanian, it is probable that the commoner species have been noted. So far the following common species have not been seen at any horizon higher than the Vanport:

Fusulinella sp.,
Cyathaxonia distorta,
Campophyllum torquium,
Chonetes mesolobus,
Productus nanus,
Spirifer rockymontanus,
Squamularia perplexa,
Dielasma bovidens,
Composita girtyi,
Astartella varica,
Pleurotomaria spironema,
Euconispira bicarinata,
Naticopsis torta,
Naticopsis altonensis,
Strophostylus remex,
Porcellia peoriensis,
Trachydomia wheeleri.

Of these species, *Spirifer rockymontanus*, *Chonetes mesolobus*, and *Squamularia perplexa* are known to occur in the Mercer limestones of western Pennsylvania, so they can not be called strictly characteristic of the Vanport. Just what species are restricted to the Vanport will not be known until the fauna of the limestones in the Pottsville is further studied.

Enough is at hand, however, to indicate that the fauna of the Vanport is much more like that of the Pottsville than it is like the fauna found in the various marine deposits of the Conemaugh.

CONEMAUGH SERIES, BRUSH CREEK LIMESTONE.

Marine fossils are found at a number of horizons in the Conemaugh. In West Virginia there is a shale with a marine fauna at the base of the series, but so far as the writer knows this shale does not occur in Pennsylvania. In this State the oldest marine fauna is found in the Brush Creek, about 100 feet above the base of the series and 350 feet above the Vanport. The Brush Creek consists of both limestone and shale, the limestone usually thin and impure, the shale fine grained and black. Fossils are abundant, and, in the shale, well preserved. This formation has an even greater extent than the Vanport, as it is found from the Allegheny Front to the western border of the State, and has been recognized in Maryland, West Virginia, and Ohio.

Fossils have been collected from the Brush Creek at Bens Creek, Donohoe, Blackburn, West Apollo, Wittmer, and Allegheny, and the commoner species so far as identified are listed in the table. The locality at Bens Creek is of some historical interest, as the type locality of the first fossils described from the Coal Measures is only a few hundred yards east from that station. These first fossils, described by Conrad in 1835, are *Turbo tabulata* (*Worthenia tabulata*), *Stylifer primogenia* (*Sphærodoma primogenia*), and *Turbo insectus*, a shell similar to, if not the same as *Pleurotomaria carbonaria*. The locality was described by Edward Miller in the Transactions of the Geological Society of Pennsylvania, Vol. I, 1835, page 251. He wrote; "The most interesting specimens found in this quarter are in a deep cutting at the head of inclined plane No. 3 [of the old Portage Railroad]. A stratum of good coal [Gallitzin] two feet thick is found at this place, having a roof of black shale four feet thick, upon which is an unstratified bed of argillaceous rock containing a great variety of shells and other marine remains."

The fossiliferous layer is not at present exposed, as the soft shales above it have crumbled down and covered it, but several loose fragments mingled with the talus show that fossils may still be obtained there. The type of *Petalodus alleghaniensis* (*P. ohioensis* Safford), described by Leidy in 1856, was also obtained at this locality.

In the fauna of the Brush Creek the mollusca predominate, the gastropoda being especially abundant. Only one common species, *Worthenia*

tabulata, seems to be confined to this stratum, but it is generally abundant and has been found at every locality at which the writer has seen the Brush Creek. In this connection it is interesting to note that the original specimens of this species came from this formation at Bens Creek. As will be seen in the table giving the range of the species, there are several other shells which have so far been found only at this horizon, but they are mostly rare forms, and so are not particularly useful in identifying the horizon. Mention may be made of *Bucanopsis marcouana*, which is quite common, but this shell is probably not confined to this horizon. *Cyrtoceras curtum* seems to be restricted to this layer, and though not common, it has been found at a number of localities. The great abundance of *Bellerophon percarinatus*, *Bucanopsis marcouana*, *Patellostium montfortianum*, *Euphemus carbonarius*, *Euomphalus catilloides*, *Astartella vera*, and the presence of *Worthenia tabulata* are the characteristics which usually serve to identify this formation. It will be noted that the smooth-shelled nautiloid of this stratum is a *Solenocheilus*, while the similar shell in the Vanport is an *Endobolus*, and the robust *Sphærodomæ* take the place of the fusiform *Solenisci* of the lower formation. *Marginifera wabashensis*, *Chonetes granulifer*, and *Ambocœlia planoconvexa*, three species which are very common at higher horizons, make their first appearance here. Altogether there is a very great change of fauna between the Vanport and the Brush Creek.

Dr. Martin evidently found this same fauna in the Brush Creek of Maryland, as is shown by the list of the fossils obtained by him at a locality one mile north of Selbysport, Garrett County. This list, which is published on page 280 of Vol. II of the West Virginia Geological Survey, contains the characteristic species, *Worthenia tabulata*, and several of the other species which are common in the Brush Creek in Pennsylvania. The only unexpected species is *Chonetes mesolobus*, which we have not yet found above the Vanport in this State.

PINE CREEK LIMESTONE.

From 60 to 90 feet above the Brush Creek is another fossiliferous layer of somewhat wide distribution. While fossils are often abundant in the Pine Creek, the writer has so far found only a few localities where good specimens can be obtained, the best collecting places being at Wittmer, Powers Run, Woods Run, and Stoops Ferry, all within a few miles of Pittsburgh.

While there are a few species which appear to be restricted to this

formation it has no such characteristic species as the Brush Creek and Vanport have. In almost every locality at which fossils have been collected from this layer nautiloids have been found to be numerous, but not well preserved. The fauna is more like that of the Brush Creek than that of the Ames, but lacks the abundance of *Orthenia tabulata* and *Astartella vera* of the one and *Chonetes granulifer* and *Tainoceras occidentale* of the other.

Woods Run Limestone.

In a note in Science (n. s., Vol. XXIX, 1909, 940) the writer announced the presence in the section at Pittsburgh of a previously unnoticed marine limestone between the Pine Creek and the Ames. To this limestone the name Woods Run may be applied, as it is best exposed on Woods Run within the city of Allegheny. Since the note mentioned was published the writer has found this layer at Sharpsburg on the Allegheny River, near Boston on the Youghiogheny, and at McKees Rocks. A few fossils are rather common in this layer but the number of species is small. *Lophophyllum profundum* is the commonest and often the only species found.

Amphibia and Reptilia.

In the red clay which always underlies the Ames in western Pennsylvania the writer found the following species in 1907. The locality is beside the highway one mile west of Pitcairn, Pa.

Desmatodon hollandi Case,
Eryops sp.,
Naosaurus ? raymondi Case,
Undetermined reptilian bones.

Nearly all the specimens were found imbedded about 30 feet below the Ames limestone. The bones are all small and belonged to many different individuals. They were evidently washed into the position they occupied when found. The layer from which they were taken is near the base of the red clay at a place where this clay is unusually thick, that is, they were in one of the basins in the eroded land surface on which this clay was deposited.

Ames Limestone.

About 125 feet above the Pine Creek and 300 feet above the base of the Conemaugh is the Ames, one of the most persistent and most fossiliferous of the marine limestones. Fossils are everywhere abundant in this stratum, but it is only under favorable conditions that any variety of species can be obtained. In almost all the localities where this limestone is seen it is a mass of specimens of *Chonetes granulifer*, *Ambocœlia planoconvexa* and *Derbya crassa*, while other fossils are not apt to be seen unless the rock is considerably disintegrated.

Fossils have been collected from the Ames at Summerhill, Blairsville Intersection, Beatty, Pitcairn, and at a number of localities within the limits of the city of Pittsburgh.

The characteristics of the Ames are the abundance of *Chonetes granulifer*, *Ambocœlia planoconvexa*, and *Derbya crassa*, and the presence of *Pugnax utah*, *Rhipidomella pecosi*, and *Tainoceras occidentale*. *Pugnax utah* and *Rhipidomella pecosi* seem to be restricted to this horizon, and *Tainoceras occidentale* makes its first appearance here. Fish teeth are fairly common, *Petalodus ohioensis* being the most abundant species. Brachiopods are very numerous in the Ames, just as the mollusca predominate in the Pine Creek and Brush Creek. Brachiopods are also very abundant in the Vanport, but the two limestones have only a few species in common.

There are very few published lists of the fossils of the Ames limestone. A classical one is that identified by Meek from fossils collected by Stevenson at Morgantown, West Virginia. This list[1] shows that the fauna at Morgantown is similar to that in Pennsylvania. In the Report on Ohio, Brooke, and Hancock Counties of West Virginia is a list of the fossils collected by Professor Grimsley from the Ames in those counties. The specimens were identified by Dr. Beede, and the species are those which are common in the Ames in Pennsylvania. In commenting on this fauna Dr. Beede discussed the probable position of the Ames in relation to the section in Kansas. While noting that most of the species listed are those which have a long range in the Pennsylvanian of that State, he is inclined to place the Ames at about the horizon of the Oread limestones, or as he says: "From the evidence at hand I should refer the Ames limestone roughly to the Shawnee division of the Kansas Pennsylvanian, as that division is limited by Haworth, or the basal part of the Shawnee."

Mr. D. Dale Condit has recently published a short list of the fossils of the Ames limestone at Carpenter, Meigs County, Ohio. This list shows that the fauna of the Ames in southern Ohio is very similar to that found in western Pennsylvania. Mr. Condit notes that *Chonetes granulifer* is so abundant as to form almost solid masses in the Ames, but is not found in the Cambridge, while *Chonetes verneuilanus* is extremely abundant in the Cambridge and is not found in the Ames. In Pennsylvania *C. verneuilanus* has not yet been found in the Ames, while it does occur in the

[1]Third Annual Report Board of Regents of West Virginia University, 1870, 67. Reprinted in West Virginia Geological Survey, Vol. II, 1903, 257, and in the County Reports of the same Survey, 1907, 127.

Pine Creek and Brush Creek. On the other hand, *C. granulifer* does occur, though sparingly, in the Brush Creek.[2]

BIRMINGHAM SHALE.

Thirty feet above the Ames is the base of the Birmingham, a shale which is usually from 35 to 50 feet thick. It has recently been discovered that this shale contains marine fossils.[3] At the base of the formation is a coal which in the region west of Pittsburgh is usually identified as the Elk Lick, though the Elk Lick is really just below the Morgantown sandstone and from 60 to 75 feet higher in the series than this coal. Both coals may be seen in the same section in Riverview Park, Allegheny. To the lower coal the name Duquesne may be applied, as it is well developed along the Monongahela River north of that town. The shale above this coal usually contains plant-stems, fragments of ferns, *Estherias*, and fish-teeth (*Diplodus*).

Along the Union Railroad below Kennywood Park, near Duquesne, crinoid columns, an undetermined gastropod, and a *Chonetes* were found in a nodule about 10 feet above the Duquesne coal. Near the top of the shale in the same locality the following species are quite plentiful:

Productus cora,
Productus semireticulatus,
Allorisma subcuneatum,
Allorisma costatum,
Cardiomorpha missouriensis,
Edmondia aspenwallensis,
Nucula ventricosa,
Acanthopecten carboniferous,
Sphærodoma sp.,
Tainoceras occidentale.

The writer has found fossils in this shale at various points from Riverview Park, Allegheny, to Glassport on the Monongahela above McKeesport, but the specimens are most numerous and best preserved at Kennywood Park, East Pittsburgh, and Wilmerding.

In the second cut on the Pennsylvania Railroad east of the station at Summerhill, Pennsylvania, the Birmingham is well exposed and consists of dark gray sandy shales with a carbonaceous layer at the base. In the lower part of the shale fragments of ferns are quite abundant, and a single insect wing was found. From the upper part a small number of specimens of a new species of *Orbiculoidea* were obtained. The interest in these specimens lies, of course, in demonstrating the marine origin of these shales at a point about 75 miles from the place where marine fossils were first found in them.

[2] *Ohio Naturalist*, IX, 1909, 485.

[3] *Science*, n. s., XXIX, 1909, 940.

Marine Shale at the Horizon of the Morgantown.

In Riverview Park, Allegheny, there is a thin-bedded black shale above the Elk Lick coal and 25 feet above the top of the Birmingham. This shale occupies the position of the Morgantown sandstone, and at this locality is full of specimens of *Aviculopecten* cf. *whitei*. This *Aviculopecten* has not been found by the writer in direct association with marine fossils, but specimens have been collected from the Birmingham shale, which is now know to be marine, and from the shale which overlies the Brush Creek.

Summary.

In the table given at the end of this paper 97 species of invertebrate fossils are listed. Of these 17 are found in both the Allegheny and Conemaugh series, 28 are found in the Allegheny series only, and 52 are restricted to the Conemaugh. If larger collections had been made and a greater area covered it is probable that these figures would have been materially altered, but it must be admitted that they indicate a great change of faunas during the time represented by the unfossiliferous strata between the Vanport and the Brush Creek. Considering the three highly fossiliferous limestones of the Conemaugh, the Brush Creek, the Pine Creek, and the Ames, it will be noticed that of the 6 species found in the three, 36 are found in at least two of them and 19 are common to all. In this connection the list of fossils identified by Meek from the Uffington shale near Morgantown, West Virginia, is of interest. The Uffington is at a horizon lower in the Conemaugh than the Brush Creek as it rests directly on the Upper Freeport coal. All the species named in this list are common in the Conemaugh of Pennsylvania and none of the species characteristic of the Vanport are present.

From the range of the individual species but little can be learned. It is a well-known fact that *Chonetes mesolobus* is confined to the lower portion of the Pennsylvanian in Kansas and elsewhere, and this proves to be true in Pennsylvania. In our collections there are, however, a number of species whose range terminates with that of *Chonetesme solobus*, but which in Kansas extend much higher in the section than does that species. Thus in Kansas *Squamularia perplexa* extends to the Hartford limestone, *Dielasma bovidens* to the Burlingame shale, *Naticopsis altonensis* to the Howard limestone, and *Trachydomia wheeleri* to the Lecompton limestone. *Pugnax utah*, *Rhipidomella pecosi*, *Ambocœlia planoconvexa*, *Worthenia tabulata*, and *Phanerotrema grayvillensis* seem to have a much wider range

in the section in Kansas than is yet known for them in Pennsylvania, where they are restricted to certain horizons in the Conemaugh. On the basis of such meager evidence it is very unsafe to venture any definite correlations, but it seems possible that the horizons of the Vanport and Parsons limestones may approximately correspond, and that the limestones of the Conemaugh were deposited at about the same time as the Lecompton and some of the limestones above it. The limestones between the Parsons and the Lecompton would then represent marine deposits in Kansas at a time when western Pennsylvania was above tide-level, and would account for the abrupt break in the sequence in faunas in this State and the greater range of the species in Kansas.

It is to be regretted that there are not more faunal lists with which to compare those here presented. Lists showing the range of the species in Ohio, Kentucky, Indiana, and Illinois might throw a great deal of light on the correlation of the coal-measures of those States.

DESCRIPTIONS OF NEW SPECIES.

Class Brachiopoda.

Family DISCINIDÆ Gray.

Genus ORBICULOIDEA d'Orbigny.

Orbiculoidea planodisca sp. nov.

Plate XXVIII, figures 12, 13.

Shell elliptical in outline, three-fourths as wide as long. The brachial valve is depressed convex, with the apex close to the posterior margin. The outline of the pedicle valve is not regularly elliptical, but the sides are somwhat pinched together and straightened back of the apex. On this valve the apex is low, nearly central, and the pedicle furrow extends behind it almost to the margin. The surface of both valves is marked by concentric growth lines, and the interior of the brachial valve is marked by a number of fine lines radiating from the beak.

One of the best preserved brachial valves is 24 millimeters long and 18 mm. wide.

One other *Orbiculoidea* with a submarginal beak is known from the Pennsylvanian. This is *O. munda* (Miller and Gurley) from Kansas City, Missouri. The brachial valve of that shell is much more convex than that of the species here described, and the sides are more nearly straight. The pedicle valve of *O. munda* is not known.

Locality.—The specimens here described were found in the upper part

of the Birmingham shale at the eastern end of the second cut on the Pennsylvania Railroad east of Summerhill, Pa.

Family ATHYRIDÆ Phillips.

Genus COMPOSITA Brown.

Composita girtyi sp. nov.

Plate XXVIII, figures 1–11.

Shell small, almost globose, with a slight fold on the brachial and flat sinus in the pedicle valve. There is considerable variation in the outline of these shells as viewed from above the brachial valve, and in the strength of the fold and sinus. In some the outline is almost circular, while in others it is oval, as the shells are sometimes longer than wide. The sinus of some specimens is merely a flattening of the ventral valve toward the front, while in others the sinus is a narrow groove extending almost to the beak. A single specimen which probably belongs to this species has a narrow sinus in both valves, like *Composita emarginata* Girty from the Permian of Texas. This is, however, the only specimen seen which shows any trace of a sinus in the brachial valve, and may represent another species. The surface is smooth except for the strong, rather distant lines of growth. The entire interior has not been seen, but weathered specimens show rather closely coiled spiral brachidia.

This shell is much smaller that *Composita subtilita* (Hall) and is readily distinguished from the young of that species by its globose form and the contour of the front of the shell. It is more closely allied to *Composita mexicana* (Hall), but the fold and sinus are not so strongly delimited as in that species.

A large specimen is 11 mm. long, 10 mm. wide, and 9 mm. in thickness. One of the narrow shells is 10 mm. long, 8 mm. wide, and 9 mm. thick. A less tumid shell is 10.5 mm. long, 10 mm. wide, and 7 mm. thick. The majority of the shells have about the proportions of the first of these.

Locality.—This is one of the most common shells in the Vanport limestone in western Pennsylvania. It has been found at Wampum, New Castle, and Kittanning. The cotypes are from the abandoned quarry between New Castle and New Castle Junction. In this quarry the shell is especially abundant, over 1,200 specimens having been picked up there. The species is named for Dr. George H. Girty, whose studies have so greatly extended our knowledge of the invertebrate faunas of the Carboniferous and Permian.

Class Amphineura.

SUBORDER Eoplacopora Pilsbry.

Family GRYPHOCHITONIDÆ Pilsbry.

GLAPHUROCHITON genus nov.

Oval, depressed chitons with granular surface, short and wide valves, the terminal margins of anterior and posterior valves depressed, the sinus slight or absent. Sutural laminæ small, the valves without lateral areas and not laterally excavated. Mucro of tail-valve at or behind the middle. Type, *Chiton carbonarius* Stevens.

Glaphurochiton carbonarius (Stevens).

Plate XXVI, figure 6; Plate XXVIII, figures 15, 16.

Chiton carbonarius STEVENS, American Journal of Science, (2), XXV, 1858, 264. —MEEK and WORTHEN, Geological Survey Illinois, V, 1873, 608, pl. 29, figs. 15a–15h.

Three specimens belonging to this species have recently been found in western Pennsylvania. One from the Ames limestone at Summerhill shows the anterior and posterior valves and fragments of some of the median valves. The anterior valve is nearly semicircular, and the frontal margin is only slightly sinuate. The tail-valve is exposed from the interior and shows well the absence of the posterior sinus. The median valve figured is from the Pine Creek limestone at Stoops Ferry, and the illustration shows its short, wide form and the granulose surface. A specimen showing the anterior and two median valves was found in the Ames at the Brilliant cut-off, Pittsburgh, but the plates are not in their natural position.

This species can not be referred to *Gryphochiton* because the posterior margin of the tail-valve is depressed instead of strongly sinuate, and it differs from *Pterochiton* in not having the valves laterally excavated and in having the frontal margin of the anterior valve only slightly sinuate. The generic name here proposed is in allusion to the smooth curve of the margin of the tail-valve.

Glaphurochiton simplex sp. nov.

Plate XXIV, figures 11, 12, Plate XXVIII, figure 14.

Anterior valve unknown. Median valves represented by a single valve which is short and somewhat rectangular in outline, a little wider than long. Apex acute, lapping the valve behind. The jugal ridge is narrow, and the sides slope abruptly. The sutural laminæ are short and wide. The surface is marked by strong lines of growth and very fine granulations.

Tail-valve ovate, wider in front than behind. Jugal ridge narrow, sharply delimited by narrow lateral furrows. The mucro is low, but sharp, situated close to the posterior margin. Posterior sinus very shallow, indented by a narrow groove. Surface marked by lines of growth and very fine granules.

As the two valves here described were found disconnected it is not certain that they belong to the same species. In any case the tail-valve is to be considered the holotype and the other valve a paratype.

The tail-valve of this species differs from that of *Glaphurochiton carboniferous* in having the mucro much further back, its position being almost median in the species described by Stevens. The surface of the new species is very finely granulose, while in the other form the granules are large.

Locality.—The two specimens which represent this species were found in the Vanport limestone in the abandoned quarry between New Castle and New Castle Junction, Pa.

DISTRIBUTION OF SPECIES.

Name.	Vanport.	Brush Creek.	Pine Creek.	Woods Run.	Ames.	Birmingham.
Fusulinella sp.	×					
Lophophyllum profundum (Milne-Edwards & Haime)		×	×	×	×	
Campophyllum torquium (Owen)	×					
Cyathaxonia distorta Worthen	×					
Ceriocrinus craigi (Worthen)			×			
Ceriocrinus sp.		×				
Hydreionocrinus sp.					×	
Columns and plates of crinoids	×	×	×	×	×	×
Septopora biserialis (Swallow)	×		×			
Thamniscus sevillensis Ulrich	×					
Rhombopora nickelesi Ulrich		×	×			
Lingula umbonata Cox		×				
Orbiculoidea missouriensis (Shumard)			×			
Orbiculoidea convexa (Shumard)					×	
Orbiculoidea planodisca sp. nov.						×
Crania modesta White and St. John					×	
Rhipidomella pecosi (Marcou)					×	
Derbya crassa (Meek and Hayden)	×	×	×	×	×	
Chonetes mesolobus Norwood and Pratten	×					
Chonetes verneuilanus Norwood and Pratten	×	×	×			
Chonetes granulifer Owen		×	×		×	
Productus semireticulatus (Martin)	×	×	×		×	×
Productus cora d'Orbigny	×	×	×	×	×	×
Productus nebrascensis Owen		×	×	×	×	
Productus punctatus (Martin)	×	×				
Productus nanus Meek and Worthen	×					
Productus pertenuis Meek		×			×	

Name.	Vanport.	Brush Creek.	Pine Creek.	Woods Run.	Ames.	Birmingham.
Marginifera wabashensis (Norwood and Pratten)		×	×		×	
Spirifer rockymontanus Marcou	×					
Spirifer cameratus Morton	×	×	×		×	
Spiriferina kentuckiensis (Shumard)	×		×	×	×	
Squamularia perplexa (McChesney)	×					
Ambocœlia planoconvexa (Shumard)		×	×		×	
Composita subtilita (Hall)	×	×	×		×	
Composita girtyi sp. nov	×					
Cleiothyridina orbicularis (McChesney)	×		×		×	
Dielasma bovidens (Morton)	×					
Hustedia mormoni (Marcou)	×				×	
Pugnax utah (Marcou)					×	
Deltopecten occidentalis (Shumard)		×			×	
Acanthopecten carboniferous (Stevens)	×	×	×			×
Pseudomonotis hawni (Meek and Hayden)					×	
Yoldia carbonaria Meek		×				
Nuculana bellistriata (Stevens)		×	×			
Nucula ventricosa Hall		×	×		×	
Edmondia aspenwallensis Meek			×		×	×
Allorisma subcuneatum Meek and Hayden		×	×		×	×
Allorisma costatum Meek and Worthen						×
Schizodus cuneatus Meek		×	×			
Macrodon sangamonensis Worthen	×					
Macrodon tenuistriatus Meek and Worthen			×			
Macrodon obsoletus Meek					×	
Astartella varica McChesney	×					
Astartella vera Hall		×			×	
Cardiomorpha missouriensis Shumard						×
Platyceras parvum (Swallow)	×	×	×		×	
Platyceras spinigerum Worthen	×	×				
Euomphalus catilloides (Conrad)	×	×	×		×	
Naticopsis altonensis McChesney	×					
Naticopsis torta Meek	×					
Trachydomia wheeleri (Swallow)	×					
Bulimorpha nitidula (Meek and Worthen)		×	×			
Trepospira illinoisensis (Worthen)		×	×			
Worthenia tabulata (Conrad)		×				
Phanerotrema grayvillensis (Norwood and Pratten)		×				
Euconispira bicarinata (McChesney)	×					
Pleurotomaria spironema Meek and Worthen	×					
Pleurotomaria carbonaria Norwood and Pratten		×			×	
Pleurotomaria granulostriata Meek and Worthen	×					
Pleurotomaria perhumerosa Meek		×				
Murchisonia terebra White	×					
Euphemus carbonarius (Cox)		×			×	
Patellostium montfortanum (Norwood and Pratten)	×	×	×		×	
Bellerophon percarinatus Conrad	×	×	×		×	
Bellerophon stevensanus McChesney					×	
Bucanopsis marcouana (Geinitz)		×				
Dentalium meekanum Geinitz		×				
Soleniscus fusiformis (Hall)	×					
Soleniscus ventricosus (Hall)					×	
Soleniscus paludinæformis (Hall)					×	
Sphærodoma primogenia (Conrad)		×				

Name.	Vanport.	Brush Creek.	Pine Creek.	Woods Run.	Ames.	Birmingham.
Sphærodoma texana (Shumard					×	
Loxonema scitulum Meek and Worthen	×					
Loxonema plicatum Whitfield					×	
Strophostylus remex (White)	×					
Anomphalus rotulus Meek and Worthen	×					
Porcellia peoriensis Worthen	×					
Glaphurochiton carboniferous (Stevens)			×			
Glaphurochiton simplex sp. nov.	×					
Orthoceras rushense McChesney		×	×		×	
Orthoceras lasallense Worthen			×			
Endobolus missouriensis (Swallow)	×					
Metacoceras sangamonense (Meek and Worthen)	×					
Domatoceras highlandense (Worthen)	×					
Cyrtoceras curtum Meek and Worthen		×				
Temnocheilus crassus Hyatt		×	×		×	
Temnocheilus winslowi Meek and Worthen			×		×	
Solenocheilus collectus Meek and Worthen		×				
Tainoceras occidentale (Swallow)					×	×
Goniatites lunatus Miller and Gurley		×	×			
Griffithides scitula Meek and Worthen		×	×			
Petalodus ohioënsis Safford		×	×		×	
Deltodus angularis Newberry and Worthen		×	×		×	
Diplodus compressus Newberry				×		×
Fissodus inæqualis (St. John and Worthen)					×	
Cladodus occidentalis Leidy					×	
Agassizodus variabilis (Newberry and Worthen)					×	

EXPLANATION OF PLATES.

PLATE XXIV.

1. *Chonetes mesolobus* Norwood and Pratten. Five pedicle valves, approximately natural size. Vanport limestone, New Castle, Pa.

2. *Chonetes verneuilanus* Norwood and Pratten. Two pedicle valves, approximately natural size. Vanport limestone, New Castle, Pa.

3. *Squamularia perplexa* (McChesney). Five specimens from the Vanport limestone at New Castle, Pa. Approximately natural size.

4. The same species. An unusually large specimen, about natural size. Vanport limestone, New Castle, Pa.

5. *Spirifer rockymontanus* Marcou. Three specimens from the Vanport limestone at New Castle, Pa. Approximately natural size.

6. *Trachydomia wheeleri* (Swallow). Four specimens from the Vanport limestone at Rochester, Pa. Approximately natural size.

7. *Soleniscus fusiformis* (Hall). A specimen from the Vanport limestone at New Castle, Pa. Approximately natural size.

8, 9. *Cyathaxonia distorta* Worthen. Three specimens from the Vanport limestone at New Castle, Pa. Approximately natural size.

10. *Septopora biserialis* (Swallow). Vanport limestone, New Castle, Pa. Approximately natural size. See plate XXV for an enlargement of this specimen.

11. *Glaphurochiton simplex* Raymond. Interior of the tail-valve (holotype). Notice slight notch in posterior margin. For dorsal view of this specimen, see Plate XXVIII. 2½ times natural size.

12. The same species. A median valve (paratype). 2½ times natural size. Both of these valves are from the Vanport limestone at New Castle, Pa.

13. An operculum which is found quite frequently where *Naticopsis torta* is common. It is similar to the operculum figured by Meek and Worthen (Paleontology Illinois, Vol. V, pl. 28), and believed by them to belong to *Naticopsis subovatus*. Our specimens are from the Vanport limestone at New Castle, Pa. The figure is about natural size.

14. *Naticopsis torta* Meek. Two specimens from the Vanport at New Castle, Pa. Approximately natural size.

PLATE XXV.

1. *Septopora biserialis* (Swallow). The same specimen as is shown in figure 10, plate XXIV. 2½ times natural size.

2. *Lophophyllum profundum* (Milne-Edwards and Haime). A specimen from the Ames limestone at the Brilliant cut-off, Pittsburgh, Pa. Approximately natural size.

3, 4. *Astartella vera* Hall. Four specimens from the Brush Creek limestone at Donohoe, Pa. Approximately natural size.

5. *Euomphalus catilloides* (Conrad). Five specimens from the Brush Creek limestone at Donohoe, Pa. Approximately natural size.

6. "*Cyrtoceras*" *curtum* Meek and Worthen. A specimen from the Brush Creek limestone at Donohoe, Pa. Approximately natural size. The impressed lines on the surface do not mark the position of the septa nor do they follow the outline of the aperture. See the following plate for another view of this specimen.

PLATE XXVI.

1. *Pleurotomaria carbonaria* Norwood and Pratten. A specimen from the Brush Creek limestone at Donohoe, Pa. Approximately natural size.

2. *Worthenia tabulata* (Conrad). Two specimens from the Brush Creek limestone at Donohoe, Pa. Approximately natural size.

3, 4. *Trepospira illinoisensis* (Worthen). Three specimens from the Brush Creek limestone at Donohoe, Pa. Approximately natural size.

5. *Sphærodoma primogenia* (Conrad). A specimen from the Brush Creek limestone at Donohoe, Pa. Approximately natural size.

6. *Glaphurochiton carbonarius* (Stevens). A median valve from the Pine Creek limestone at Stoop's Ferry, Pa. 2¼ times natural size.

7. *Petalodus ohioënsis* Safford. A specimen from the Brush Creek limestone at Donohoe, Pa. Approximately natural size. This species is known under a variety of names, *Petalodus alleghaniensis* and *P. destructor* being the ones most frequently used. Safford gave two figures and a brief description of specimens obtained at Cambridge, Ohio, from a limestone at about the same horizon as the Brush Creek, and Leidy later described *P. alleghaniensis* from a specimen obtained from the Brush Creek in Pennsylvania.

8. "*Cyrtoceras*" *curtum* Meek and Worthen. Interior of the specimen figured on the preceding plate. Notice the very deep hyponomic sinus.

PLATE XXVII.

1. *Chonetes granulifer* Owen. Six specimens from the Ames limestone at the Brilliant cut-off, Pittsburgh, Pa. Approximately natural size.

2. *Petalodus ohioënsis* Safford. A specimen from the Ames limestone at City Farm, opposite Homestead, Pa. Approximately natural size.

3. *Pugnax utah* (Marcou). Three specimens from the Ames limestone at the Brilliant cut-off, Pittsburgh, Pa. Approximately natural size.

4. *Lophophyllum profundum* Milne-Edwards and Haime. Two specimens from the Ames limestone at the Brilliant cut-off, Pittsburgh, Pa. Approximately natural size.

5, 6. *Allorisma subcuneatum* Meek and Hayden. Two specimens from the Birmingham shale below Kennywood Park, near Duquesne, Pa. Approximately natural size.

7. *Tainoceras occidentale* (Swallow). View of the venter of a specimen from the Ames limestone at Pitcairn, Pa. Approximately natural size. Collected by the Rev. P. E. Nordgren.

8. *Derbya robusta* (Hall). A specimen from the Ames limestone at Glenwood, Pa. Approximately natural size.

PLATE XXVIII.

1. *Composita girtyi* Raymond. Three views of a wide individual with a shallow sinus and nearly equal valves. All of figures 1–11 are one-half larger than natural size, and are all from specimens collected from the Vanport limestone at New Castle, Pa.

2. The same species. A specimen similar to the preceding, but with a deeper sinus.

3. The same species. A narrow individual with a deep pedicle valve.

4. The same species. A narrow shell with almost no sinus.

5. The same species. A small specimen with a slight sinus in both valves.

6. The same species. A narrow individual with a very convex pedicle valve.

7. The same species. A wide specimen with subcircular outline and shallow sinus.

8. The same species. A narrow shell with pentagonal outline and convex valves.

9. The same species. Four views of a somewhat square shell with nearly equal valves and a slight sinus.

10. The same species. A narrow shell with an extremely convex pedicle valve.

11. The same species. Four views of a wide shell with a pronounced sinus and nearly equal valves.

12. *Orbiculoidea planodisca* Raymond. A dorsal valve from the Birmingham shale at Summerhill, Pa. Natural size.

13. The same species. A pedicle valve from the same locality. Natural size.

14. *Glaphurochiton simplex* Raymond. A tail-valve (holotype), from the Vanport limestone at New Castle, Pa. Twice natural size.

15, 16. *Glaphurochiton carbonarius* (Stevens). Copies of Meek and Worthen's figures of the tail-valve to illustrate the characters of the genus and to compare with the figure of *G. simplex*.